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SPILLS ACTION CENTRE

SUMMARY REPORT OF 1992 SPILLS

NOVEMBER 1993



Ontario

**Ministry of
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SPILLS ACTION CENTRE
SUMMARY REPORT OF 1992 SPILLS

Report prepared by:

Spills Action Centre
Regional Operations Division

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EXECUTIVE SUMMARY

The Ontario Ministry of Environment and Energy's Spills Action Centre receives and initiates responses to reports of spills and other urgent environmental incidents on a 24-hour per day basis. The Centre documented 14,588 occurrences in 1992. Spills accounted for 5,014 of these occurrences; the remainder included a combination of Ministry-required notifications other than spills, and environmental complaints from the general public. This report provides a summarized review of spills reported to the Ministry during the calendar year of 1992, and compares this information to that obtained in previous years.

The number of spills reported to the Ministry in 1992 declined by about 5% from 1991. This is the second consecutive yearly decrease in reported spills. Fewer spills to air accounted for this decrease while the number of spills to land and water remained virtually unchanged.

Oils and fuels represented 59% of spilled materials. Chemicals and chemical solutions accounted for 15%, wastes and waste waters 18%, gaseous emissions 6%, while other and unknown materials accounted for the remainder. A large proportion of the reported spills involved small volumes: cumulatively, 20% of the spilled materials involved volumes less than 10 litres, 57% less than 100 litres and 86% less than 1000 litres.

About 28% of the spills had a confirmed environmental impact identified. More than two-thirds of these involved soil contamination, and approximately one-fifth involved water pollution. Twenty-three spills were reported to have resulted in human health and safety concerns.

Spill cleanup information from 1992 indicates that 45% of the spills were completely cleaned up and an additional 22% were partially cleaned up. The majority of the remainder involved spills to water where cleanup was more difficult, and some spills to the atmosphere which could not be cleaned up at all.

The industrial sectors with the largest proportions of reported spills were: transportation - 16%; petroleum - 13%; metallurgical - 6%; general manufacturing - 5%; and chemical - 5%. Public sector spills, including spills from electric utilities and sewage systems, accounted for about 18% of reported spills.

Motor vehicles were the largest source of spills, accounting for more than 28% of all reported spills. Spills from manufacturing and processing facilities accounted for an additional 19%.

In 1992, 1,453 of the spills reported to the Ministry were either entirely or partially discharged to water courses. Of these, 203 involved oil or chemical spills to the Great Lakes system including: 65 to Lake Ontario, 41 to the St. Clair River, 36 to the St. Lawrence River, 18 to Lake Huron, 12 to Lake Erie, and 12 to Lake Superior. The remainder were to the Detroit River, St. Marys River, Lake St. Clair and the Niagara River. Overall there were 85 fewer spills to the Great Lakes system in 1992 as compared to 1991.

All occurrences reported to the Ministry, including spills, are recorded on a computerized data management system called the Occurrence Report Information System. The information stored on this system is used to assist the Ministry and others, such as Environment Canada and the International Joint Commission on the Great Lakes, in identifying and evaluating environmental problems.

Ministry pollution abatement programs and spill reduction initiatives are developed or modified as trends or concerns are identified using this type of information. The Ministry has implemented a province-wide *Spills Prevention Strategy* requiring repeat dischargers to submit spill prevention and response plans to the Ministry and to incorporate better management practices. About 30 companies currently involved in this process are submitting comprehensive work plans for review by the Ministry.

The Ministry is actively involved in planning for spill contingencies. The Ministry's Contingency Planning Program provides advice and assistance to industry and other government agencies that respond to spills. The Ministry is also responsible for the *Province of Ontario Contingency Plan for Spills of Oil and Hazardous Materials* which provides a mechanism to deal with major spills under provincial jurisdiction.

INTRODUCTION

This report is the fifth annual summary of occurrences reported to the Ontario Ministry of Environment and Energy's Spills Action Centre. The purpose of this report is to provide a summarized review of spills reported to the Ministry during the calendar year of 1992 and to compare this information to that obtained in previous years.

Ontario's Spills Legislation

The Environmental Protection Act (EP Act) defines a spill, with reference to a pollutant, as:

"...a discharge into the natural environment, from or out of a structure, vehicle or other container, and that is abnormal in quantity or quality in light of all the circumstances of the discharge." (Part X, Section 91(1)).

A spill is reportable if it causes or is likely to cause an adverse effect, such as injury or damage to property or to plant or animal life, harm or material discomfort to any person, or any other adverse effect listed in Section 1(1) of the Act. The person who had control of the pollutant immediately prior to the spill and the person who spills, causes, or permits the spill must report the discharge to the Ministry based on their determination of the likelihood of adverse effects.

Part X of the EP Act establishes:

- the requirement to immediately notify the Ministry, the municipality in which the spill occurred and, in some cases, the owner of the pollutant and the person in control (if they are not already aware of the spill);
- the duty to clean up spills;
- the right for municipalities to respond to spills and to recover costs;
- a process, as a last resort, for the Minister of Environment and Energy to direct Ministry staff or to order the discharger or anyone else to respond to the spills;
- the right to compensation for costs and damages incurred;
- the Environmental Compensation Corporation to provide limited assistance in compensating certain victims of spills.

The Spills Action Centre

The Spills Action Centre (SAC) began operations on November 29, 1985, the same day that Part X of the EP Act came into force. The primary role of the Centre is to receive and initiate response to notifications of spills and other urgent environmental matters on a 24-hour per day basis. The Centre is also responsible for the Ministry's Contingency Planning Program, maintaining the *Province of Ontario Contingency Plan for Spills of Oil and other Hazardous Materials*, and promoting and reviewing the development of industrial and municipal spill contingency plans. The Ministry's province-wide, toll-free number 1-800-268-6060 is used by industry, response agencies and the public for notifying the Ministry of spills and other urgent environmental incidents. As this telephone number has become better known, it has been used increasingly for a variety of other environmental matters including a range of ministry-required notifications, in addition to environmental complaints from the general public.

Environmental officers at the Centre evaluate all reported occurrences and decide what type of response is necessary. This may include any combination of the following:

- Contacting suspected pollution sources in an attempt to verify and resolve the problem;
- Contacting various agencies or potentially affected parties as needed, for example, police, fire departments, local municipal authorities, health officials, Canadian Coast Guard, US authorities, etc.;
- Contacting local Ministry of Environment and Energy (MOEE) personnel to initiate a field response;
- Notifying senior MOEE management and coordinating Minister's orders or directions when necessary;
- Maintaining liaison with the agencies in charge of public safety in an emergency and coordinating MOEE's support for their efforts;
- Providing information on chemicals and cleanup techniques, either directly or through CANUTEC, Transport Canada's national 24-hour centre;

The Occurrence Report Information System

All occurrences reported to the Ministry are recorded on a computerized database management system called the Occurrence Report Information System (ORIS). This system enables the Ministry to track the status of occurrences, and facilitates data retrieval for the purpose of preparing routine summaries and performing non-routine data searches. Each occurrence report consists of a text summarizing the incident and several coded fields which facilitate data retrieval. A sample occurrence report is included in Appendix I of this report.

Initial information on spills and emergencies is often incomplete and changes as more information becomes available. Since some incidents take a long time to resolve, the information presented in this report is a "snapshot" of the information that existed in the database at the time summaries were generated. However, it is expected that any changes to the information in the database will have only a minor effect on the summaries presented in this report.

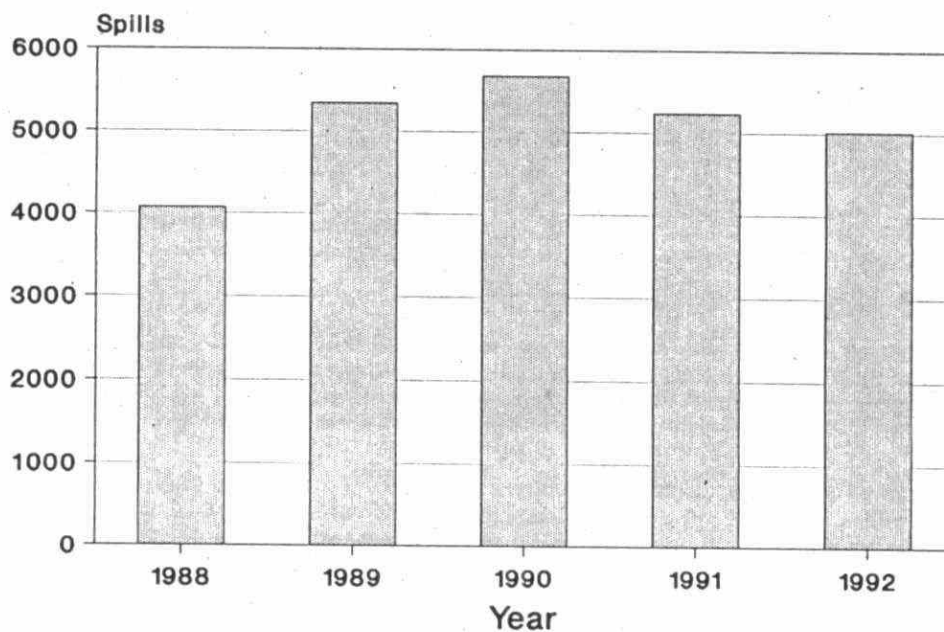
SPILLS -- 1992 SUMMARY

This part of the report summarizes the number and type of spills reported to the Ministry of Environment and Energy during 1992. The report compares this information to the data from previous years.

YEARLY SPILL TOTALS

Figure 1 depicts the change in the number of reported spills from 1988 to 1992. The total number of spills rose from 4,072 in 1988 to 5,686 in 1990. This was approximately a 40% increase. In 1991, the number of reported spills dropped by more than 8% to 5,239. This decrease continued in 1992 when there were 5,014 spills reported, representing a 5% decrease from 1991.

Figure 1
Reported Spills - 1988 to 1992



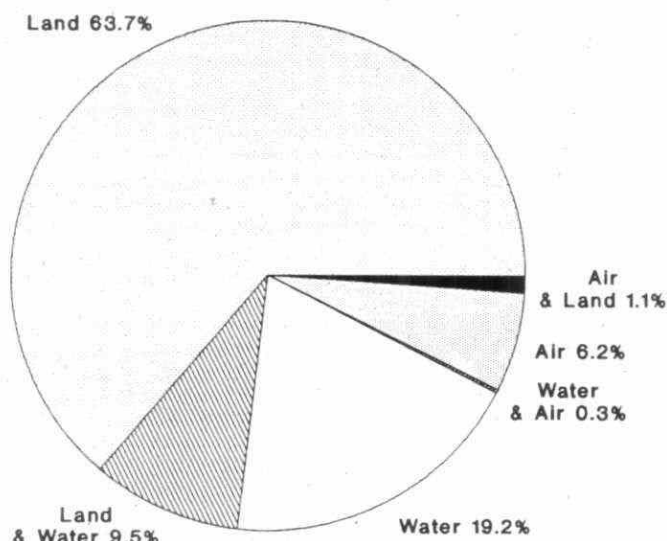
SPILLS TO LAND, WATER AND AIR

In 1992 there were 3,194 spills to land, 965 spills to water and 311 spills to air. Spills which affected a combination of these media accounted for an additional 544 spills. Table 1 shows the number of spills which affected each of these media and Figure 2 shows the relative percentages of these spills. Spills to land accounted for 63.7% of all spills, and 19.2% of all spills were discharges to water. An additional 9.5% of spills were discharges to land and water. Spills to air, water and air, and air and land accounted for 7.6% of all spills.

TABLE 1
Spills By Receiving Medium – 1988 to 1992

MEDIUM	YEAR				
	1992	1991	1990	1989	1988
Land	3 194	3 117	3 144	2 996	2 261
Land & Water	475	524	467	355	243
Water	965	1 050	1 305	1 135	969
Water & Air	13	18	23	8	5
Air	311	447	649	776	543
Air & Land	56	81	98	75	51
TOTAL	5 014	5 237	5 686	5 345	4 072

Figure 2
Spills By Receiving Medium - 1992



LOCATION OF SPILLS

Municipalities with the largest population generally have the greatest number of reported spills. However, due to the concentration of industrial activities, some municipalities have a proportionately higher number of spills occur within their boundaries. Table 2 shows the number of spills that occurred within each upper-tier municipality in 1992¹.

TABLE 2
Spills By Municipal Location

MUNICIPALITY	SPILLS 1992	MUNICIPALITY	SPILLS 1992
Metropolitan Toronto	529	Peterborough County	68
Hamilton-Wentworth R.M.	355	Bruce County	62
Niagara R.M.	233	Frontenac County	62
Ottawa-Carleton R.M.	232	Northumberland County	56
Peel R.M.	218	Parry Sound District	55
Sudbury R.M.	202	Brant County	46
Thunder Bay District	188	Sudbury District	46
York R.M.	179	Huron County	45
Lambton County	177	Prescott & Russell County	44
Durham R.M.	150	Kent County	43
Simcoe County	148	Grey County	42
Waterloo R.M.	132	Oxford County	36
Leeds & Grenville County	132	Victoria County	36
Stormont, Dundas & Glengarry County	131	Timiskaming District	36
Halton R.M.	130	Lanark County	35
Haldimand-Norfolk R.M.	116	Rainy River District	35
Algoma District	111	Lennox & Addington County	31
Renfrew County	97	Elgin County	28
Cochrane District	95	Perth County	22
Middlesex County	91	Dufferin County	21
Kenora District	84	Prince Edward County	19
Wellington County	83	Haliburton County	16
Hastings County	80	Manitoulin District	9
Essex County	79	Out-of-Province	2
Nipissing District	77		
Muskoka D.M.	70	TOTAL	5 014

¹An expanded version of this table, including population & area data for each municipality, is in Appendix V.

TYPES AND VOLUMES OF MATERIALS SPILLED

The 5,014 spills reported in 1992 involved a total of 5,211 spilled materials. A number of spills involved more than one spilled material; therefore, the total number of materials spilled exceeds the total number of reported spill occurrences. ORIS has five categories of materials: oils, chemicals, gases, wastes, and other materials. Table 3 compares the number of spills by material group and year and Figures 3 and 4 show the relative number of spills by material groups, and volume and material type, respectively. This information is discussed in the section that follows. The results show a continued decline in the number of chemical and gaseous spills since 1989.

TABLE 3
Spills By Material Group – 1988 to 1992

MATERIAL GROUP	YEAR				
	1992	1991	1990	1989	1988
Oils	3060	2965	3144	2831	2136
Chemicals	784	982	1031	1118	798
Gases	326	472	717	864	546
Wastes	942	948	1032	763	602
Other	65	92	30	32	24
Unknown	34	32	37	81	96
TOTALS	5211	5491	5991	5689	4202

Figure 3
Material Groups

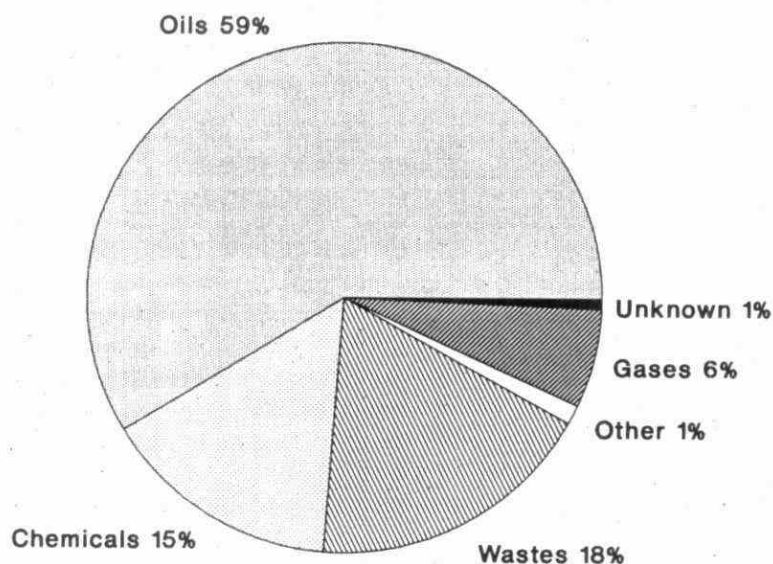
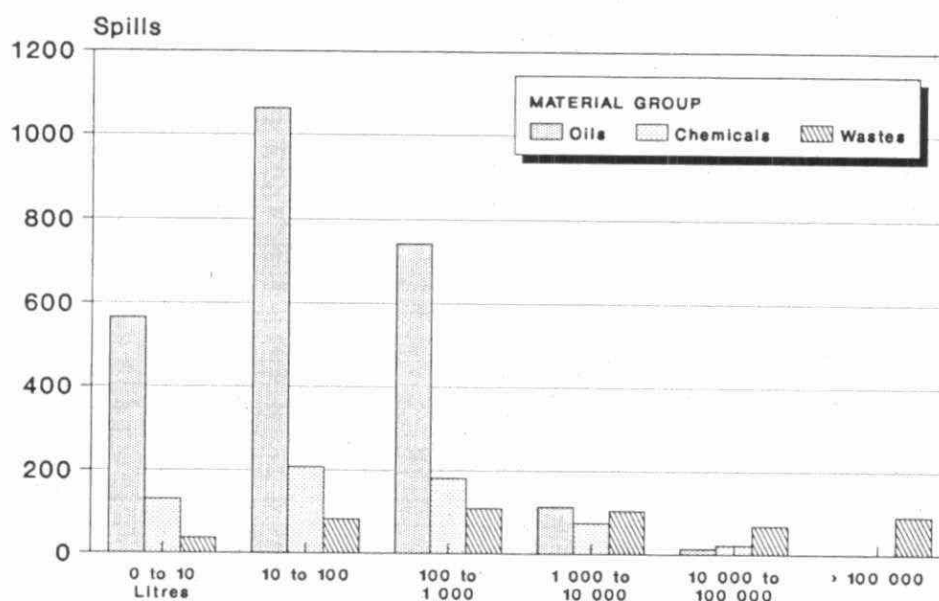


Table 4 shows material groupings summarized by the volume spilled. An expanded summary of materials and volumes is presented in chart form in Appendix II. A large portion of reported spills involved small volumes. Cumulatively, 20% of the spilled materials (where quantities were known) involved volumes of less than 10 litres, 57% involved volumes less than 100 litres, 86% involved volumes less than 1,000 litres, and 94% involved volumes less than 10,000 litres. These figures are indicative of a continuing trend by industry and others to report small volume spills. Figure 4 illustrates these trend graphically for the three major material categories - oils, chemicals and wastes.

TABLE 4
Spills By Material Group And Volume

MATERIAL GROUP	VOLUME (Litres)						Unknown
	0 to 10	10 to 100	100 to 1 000	1 000 to 10 000	10 000 to 100 000	More than 100 000	
Oils	565	1062	741	114	15	1	562
Chemicals	132	208	181	77	23	0	163
Gases	11	23	22	3	5	4	258
Wastes	37	85	110	106	70	94	440
Other	1	10	8	12	13	1	20
Unknown	5	2	2	0	0	0	25
TOTALS	751	1390	1064	312	126	100	1468

Figure 4
Spill Volumes By Material Type



Volume was known for 76%
of the spilled materials in these groups

Oils

In 1992, 3,060 of the materials spilled were oils, accounting for 59% of all spilled materials. Many of these are operating fuels that spilled as a result of transportation accidents or fuel leaks from fixed storage facilities.

About 82% of all oil spills had a reported volume. Cumulatively, 23% of these spills were less than 10 litres each, 65% were less than 100 litres, and 95% were less than 1,000 litres. As the data in Table 4 shows, spills of oils involving volumes between 10 and 100 litres was the single largest grouping, accounting for 20% of all spilled materials. The second largest grouping was spills of oils involving volumes between 100 and 1,000 litres. Many of these spills were discharges from motor vehicle fuel tanks and residential furnace oil storage tanks.

Chemicals

In 1992, 784 of the materials spilled were chemicals accounting for 15% of all spilled materials.

About 79% of all chemical spills had a volume reported. Cumulatively, 17% of these spills were less than 10 litres each, 55% were less than 100 litres, and 84% were less than 1 000 litres. Unlike the oils category, the chemical category includes chemical solutions, however the contaminant of concern (the chemical) often constitutes a relatively small portion of the total volume spilled. Consequently, spills of chemicals are frequently greater in volume than oils.

Gases

Three hundred and twenty-six of the materials spilled were in gaseous form, accounting for 6% of all spilled materials. It is difficult to quantify the volume of gas emitted to air in an occurrence. Few such reports contain volume information. In 1992, only 21% of the gaseous spills had a known volume.

Wastes

Spills of wastes accounted for 18% of all spilled materials. This category includes materials that were considered wastes *prior* to the spill occurrence. They may have originated as byproducts of industrial processes or may involve unusually high concentrations of pollutants in otherwise normal wastewater discharges.

About 53% of all waste spills were of a known volume. Cumulatively, 7% of these spills were less than 10 litres each, 24% were less than 100 litres, 46% were less than 1,000 litres, 67% were less than 10,000 litres, and 81% were less than 100,000 litres. A relatively higher percentage of waste spills (as compared to the oil and chemical categories) involved volumes larger than 1,000 litres. Spills involving wastes typically involve larger volumes because this category includes wastewater discharges that are often large volumes with a small percentage of contaminant or contaminants at concentrations just above acceptable levels.

Other Materials

Spills of other materials, not included in the four groups mentioned above, accounted for 1% of all spilled materials. Fewer than 1% of all spilled materials were not identified and were documented as unknown.

Figure 5
Environmental Impact

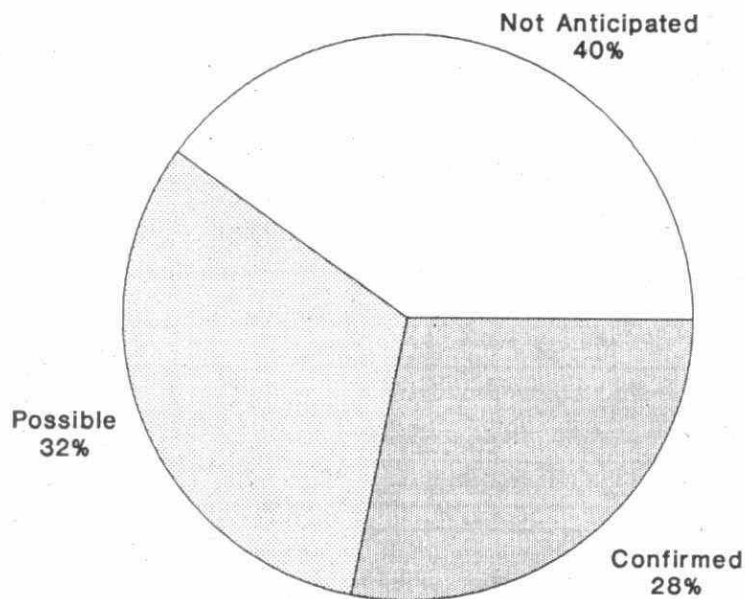
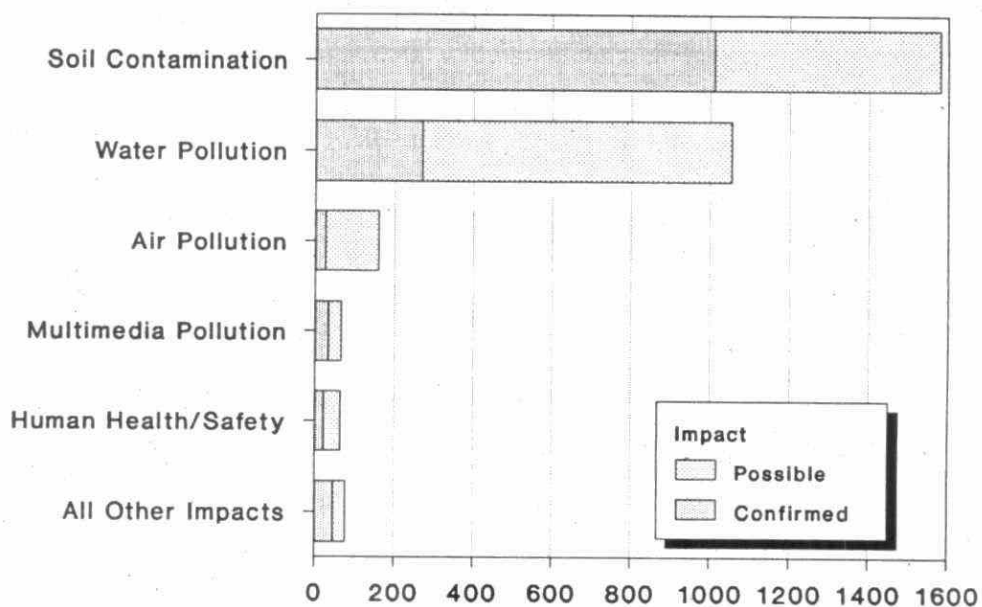


Figure 6
Nature of Environmental Impact



ENVIRONMENTAL IMPACT

The spills summarized in this report involve a wide range of materials, quantities, and circumstances, all of which can contribute to the impact of the spill on the environment. In order to provide some measure of the seriousness of a spill, the Ministry documents the likelihood of an environmental impact resulting from each spill. In 1992, an environmental impact was confirmed for 28% of all spills. An additional 32% of the spills had possible environmental impacts. The remaining 40% of the spills did not have anticipated environmental impacts. Table 5 summarizes the likelihood of impact for the spills where a confirmed or possible impact was identified. This information is illustrated in Figure 5.

TABLE 5
Nature of Environmental Impact

IMPACT	CONFIRMED	POSSIBLE
Soil Contamination	1010	571
Water Pollution	271	783
Air Pollution	25	136
Multi-Media Pollution	34	32
Human Health/Safety	22	42
Other Impact	32	19
Vegetation Damage	11	11
Injury to Wild Life	3	2
TOTAL	1408	1596

The environmental impact data field is not an accurate indicator of the full extent of the impact. For example, a spill that has a confirmed soil contamination impact may involve a spill of a small volume of material, necessitating the removal of a few shovels-full of contaminated soil. A spill of a larger volume may involve the removal of several hundred cubic metres of contaminated soil, however the impact for both would be *soil contamination*. The true extent of environmental impact for individual spills depends on a number of factors, including the volume and type of substance spilled, the location, the extent of the impact and the season. Combining the individual impacts of each spill does not provide a realistic measure of the cumulative impacts of all spills on the environment.

Figure 6 reflects the environmental impact of spills which had confirmed or possible impacts. The figure shows clearly that the largest confirmed impact was soil contamination. The figure also shows that a significant proportion of spills were identified as having a possible or confirmed water pollution impact. Only a small number of spills posed a threat to human health and safety.

Figure 7
Spill Cleanup

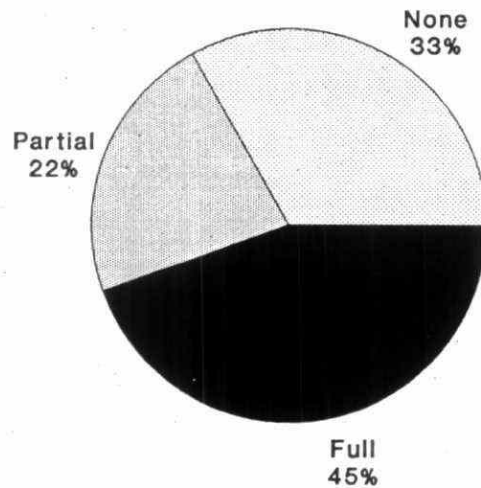
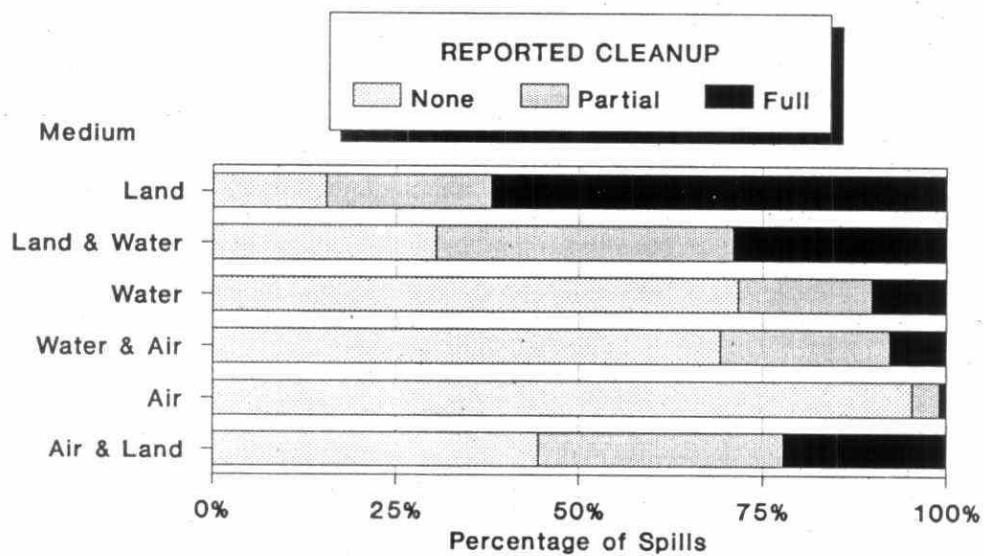


Figure 8
Spill Cleanup By Medium



Spill cleanup was reported for 4 863 (97%) spills.

SPILL CLEANUP

Part X of the Environmental Protection Act requires that spills be cleaned up promptly and to the extent practicable. It places the primary cleanup responsibility on the discharger, that is the person who owned as well as the person who had control of the pollutant immediately prior to the spill. In most cases, spills are cleaned up by the person responsible for the discharge, or a contractor hired by them. Municipalities can, and often do, clean up spills, particularly if the spill occurs on municipal roads or into a municipal drainage system or watercourse.

In 1992, cleanup data was available for 97% of all spills. The cleanup success rate by spill medium is summarized in Table 6 and in Figures 7 and 8. The success of cleanup efforts is dependent upon a number of factors, including the properties of the spilled material, the accessibility of the spill site, the availability of expertise and resources, and the time required to mobilize a response. Environmental factors play a role as well, since weather and light conditions, and the type of soil or watercourse affected can further complicate or aid the success of the cleanup. As the data from 1992 indicates, spills to land have a much higher cleanup success rate than do spills to surface waters; releases of gaseous substances to the atmosphere are normally impossible to clean up. Spills to land & water or land & air have a higher clean up success rate than the spills to water or air alone. The spills to air & land, and the spills to water & air, typically involve materials that vapourize, making it possible to clean up the land or water-based component but not the airborne emission.

TABLE 6
Spill Cleanup By Medium

SPILL MEDIUM	PERCENT CLEANED UP			
	0%	1-50%	51-90%	91-100%
Land	481	181	518	1 924
Land & Water	137	80	102	130
Water	673	85	86	95
Water & Air	9	2	1	1
Air	290	4	7	3
Air & Land	24	7	11	12
TOTAL	1 614	359	725	2 165

Figure 9
Spills By Sector

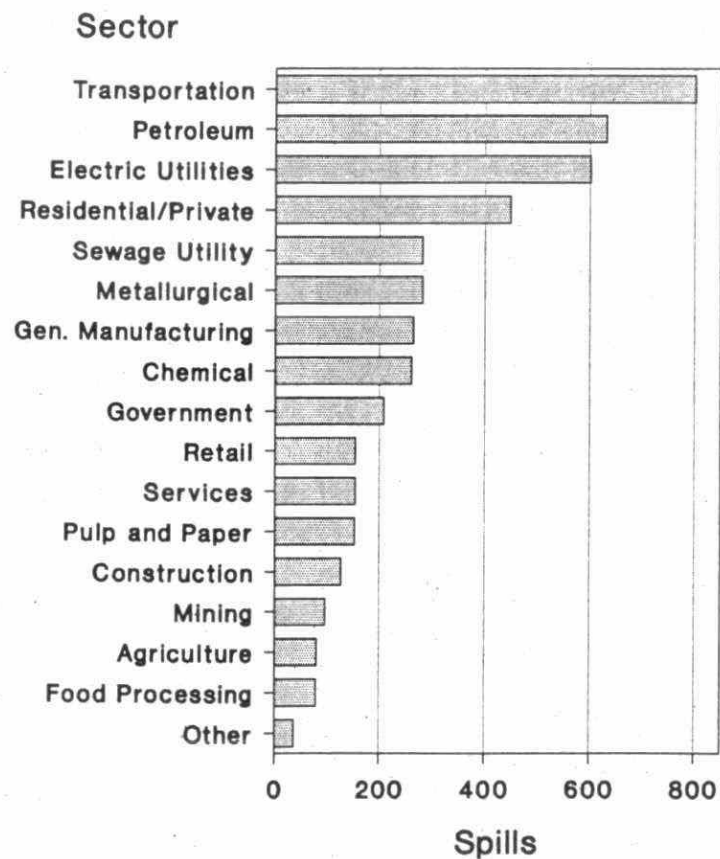
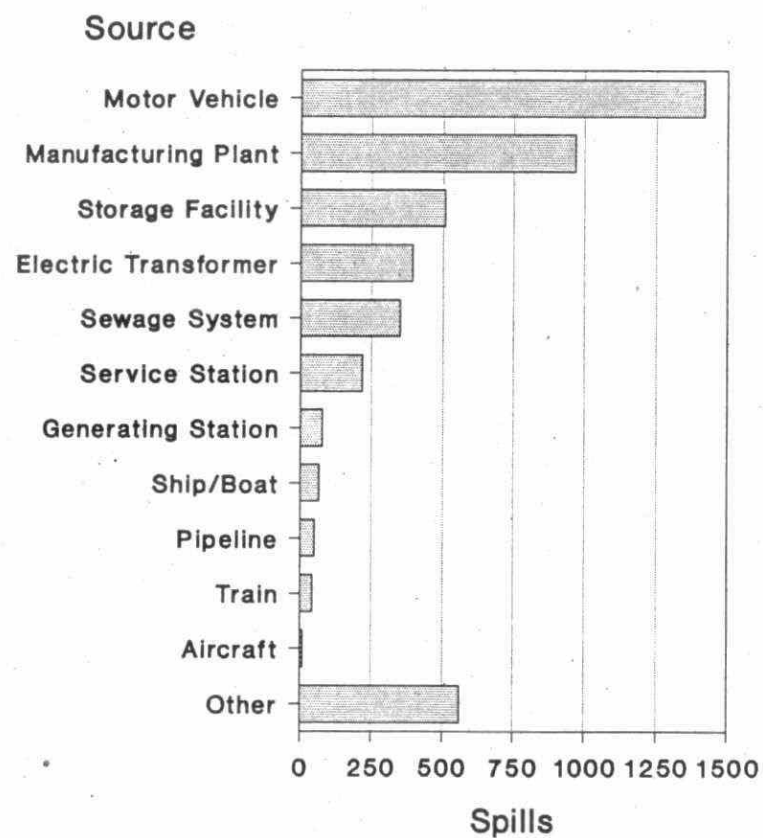


Figure 10
Spills By Source



Source and Sector were
unknown for 351 Spills.

SPILLS BY SECTOR AND SOURCE

Several years ago, the Canadian Department of Environment developed a computerized database called the *National Analysis of Trends in Emergencies System* (NATES). Like ORIS, this system uses a number of coded fields to classify environmental reports, thereby enabling the storage and analysis of information pertaining to spills. The MOEE adopted some of these codes for use with ORIS to ensure that different government agencies in Canada could exchange information easily. Each occurrence documented by the MOEE uses the NATES codes to classify the sector and source responsible for the discharge. In addition, ORIS uses Standard Industrial Classification codes to provide more detailed descriptions of the sector code. Together, these three codes are used to analyze the sectors and sources responsible for spills to the environment.

Analysis By Sector

The industrial sectors with the largest numbers of reported spills in 1992 were transportation², petroleum, metallurgical, general manufacturing, and chemical sectors. Collectively, spills from these five sectors accounted for nearly half of all spills reported in 1992. Electric utilities, sewage utilities and private residents accounted for the majority of non-industrial sector spills. Figure 9 summarizes spills by the various industrial and service sectors. Table 7 lists the number of spills for these sectors over the past 5 years.

TABLE 7
Spills By Sector – 1988 to 1992

SECTOR	YEAR				
	1992	1991	1990	1989	1988
Transportation	801	776	834	726	467
Petroleum	632	700	712	654	561
Electric Utilities	601	711	525	566	508
Sewage Utilities	282	248	296	250	198
Metallurgical	281	414	476	504	460
General Manufacturing	264	342	394	446	319
Chemical	261	343	492	454	334
All Others (Combined)	1 892	1 703	1 957	1 745	1 225

When combined, the spills of the seven sectors identified in Table 7 account for 67% of all spills reported in 1992. The relative percentage of spills for each of these sectors has remained similar in each year, with the exception of a decline in spills involving the metallurgical and chemical sectors since 1990.

² The transportation sector includes companies and individuals whose *only* business is providing transportation services. Spills from vehicles owned or operated by the other sectors (e.g. petroleum, chemical) are included in the figures for each of those sectors, even though they involved a mode of transportation.

Analysis By Source

The source categories with the largest number of reported spills in 1992 were motor vehicle, manufacturing plant or factory, storage facility, electric transformer or capacitor, sewage system and vehicle service station. Together, these 6 categories accounted for 77% of all reported spills. Table 8 provides a comparison of these sectors spills from 1988 to 1992. Figure 10 is a summary of spills arranged by the source of the discharge.

TABLE 8
Spills By Source – 1988 to 1992

SOURCE	YEAR				
	1992	1991	1990	1989	1988
Motor Vehicle	1 419	1 364	1 412	1 127	718
Manufacturing Plant/Factory	968	1 305	1 571	1 572	1 284
Storage Facility	508	524	659	372	243
Electric Transformer	393	412	407	334	313
Sewage System	349	268	307	274	230
Vehicle Service Station	218	269	316	263	217
All Others (Combined)	1 159	1 095	1 014	1 403	1 067

Spills By Sector and Source

A summary of the typical combinations of sector and source codes provides additional information. There are a possible 238 sector and source code combinations³, of which 13 combinations account for 62% of all spills. By adding the remaining spills which involve motor vehicles, storage facilities and manufacturing plants, 75% of all spills are accounted for. Table 9 lists the major combinations of source and sector codes used in 1992.

TABLE 9
Spills By Sector and Source

SECTOR	SOURCE	SPILLS	PERCENTAGE
Transportation	Motor Vehicle	651	13
Electric Utilities	Transformer	387	8
Sewage Utilities	Sewage System	282	5
Chemical	Manufacturing Plant	233	5
General Manufacturing	Manufacturing Plant	229	5
Metallurgical	Manufacturing Plant	200	4
Petroleum	Motor Vehicle	197	4
Residential	Storage Facility	186	4
Petroleum	Service Station	182	4
Residential	Motor Vehicle	166	3
Pulp & Paper	Manufacturing Plant	146	3
Electric Utilities	Motor Vehicle	123	3
Petroleum	Storage Facility	115	3
All Other Sectors (Combined)	Motor Vehicle	282	5
All Other Sectors (Combined)	Manufacturing Plant	160	3

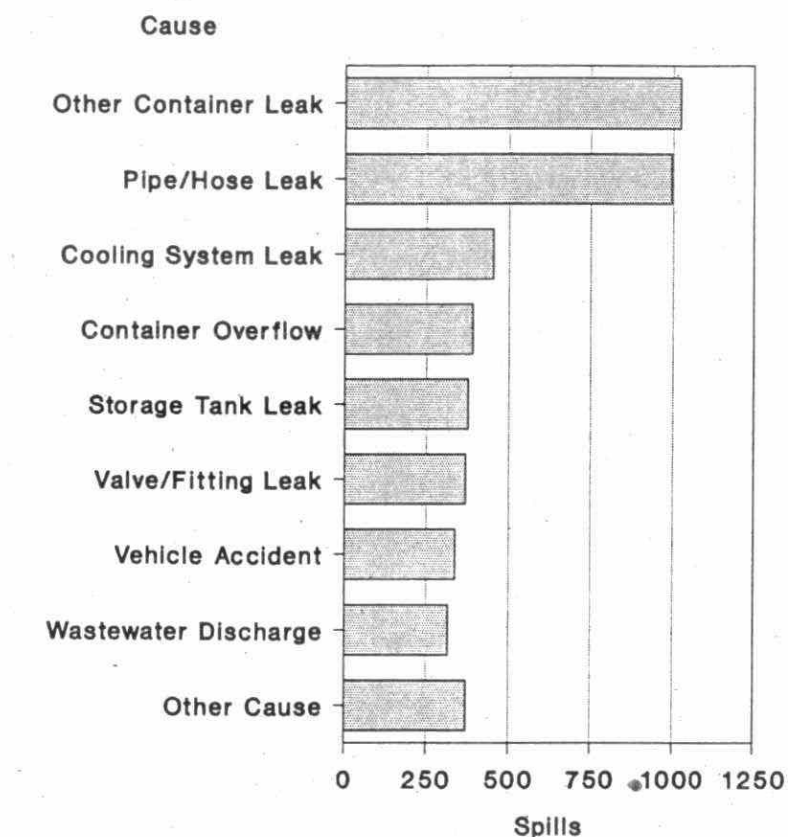
³Refer to Appendix III for a complete table of all the sector and source combinations.

The highlights of the combined sector and source data presented in Table 9 are:

- The *transportation-motor vehicle* combination accounted for 13% of all spills. These include spills of cargo and operating fluids, primarily from transport trucks and tankers. Adding the spills from the motor vehicles of all other sectors brings this total to 1,419 spills (28% of all spills). Spills from other transport modes (aircraft, watercraft and trains) account for an additional 119 spills.
- If the *chemical, petroleum, metallurgical and pulp and paper manufacturing plants'* spills are combined, they account for 16% of all spills. This figure increases to 19% when the spills from all other sectors' manufacturing plants are included.
- The *electric utility-transformer* combination accounted for 8% of all spills. Ontario has a vast network of these units, increasing the potential for this type of spill. Typically, these spills involve small amounts of oil spilled when transformers fail or are accidentally ruptured. Cleanup of these spills is a routine matter for most utilities.
- The *sewage utilities-sewage systems* combination accounted for 5% of all spills. These spills included sewage bypasses caused by equipment failure at sewage plants and pumping stations, and breaks in sewer force mains.
- There were 186 spills from *residential-storage facilities*. This combination is used to classify spills of furnace oil from residential storage tanks and represents 4% of all spills. These spills are usually larger in volume than the average oil spill and often involve people of limited or little resources.
- There were 182 spills involving the *petroleum-service station* combination during 1992. An additional 115 spills occurred at *petroleum sector storage depots*. The service stations are typically retail outlets for vehicle fuels, while the storage depots are usually privately operated sites where fuels are stored in bulk quantities. Spills at these sites typically involve leaks of petroleum products from storage tanks, fuel draining from hoses, and overflows that occur while vehicle tanks are being filled.

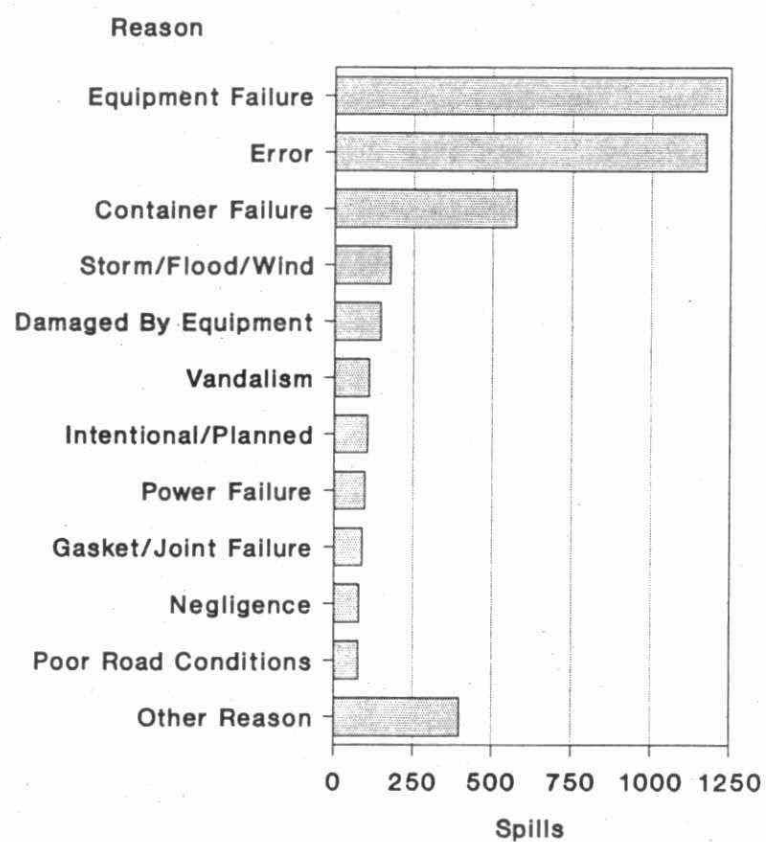
In some cases, the Ministry is unable to determine the source of a spill. Typically, these occurrences involve spills to roads, ditches or watercourses where the source of the material is undetermined. Some of these occurrences also involve the illegal dumping of materials. The source and sector was not known for 331 spills (7%) reported in 1992.

Figure 11
Spills By Cause



The cause was not known for 376 Spills

Figure 12
Spills By Reason



The reason was not known for 830 Spills

SPILLS BY CAUSE AND REASON

ORIS uses the NATES codes as a basis for summarizing the cause and reason for each spill. The "cause" is used to describe how a spill occurred and the "reason" attempts to clarify the cause by identifying the primary contributing factor. For example, a *transportation accident* (cause) due to *adverse road conditions* (reason) is a typical combination.

Table 10 summarizes the 7 major cause categories for 1992. Together, these categories account for 80% of all reported spills. The relative percentages for these categories have remained similar throughout the past five years. Table 11 summarizes the most frequently reported reason categories for spills in 1992. Together, these seven categories accounted for 85% of all spills reported in 1992. The same categories accounted for a similar percentage of spills in previous years.

TABLE 10
Spills By Cause – 1988 to 1992

CAUSE	YEAR				
	1992	1991	1990	1989	1988
Container Leak	1 025	1 002	1 109	712	472
Pipe or Hose Leak	996	974	803	595	291
Cooling System Leak	453	464	441	387	260
Container Overflow	390	533	672	492	455
Storage Tank Leak	377	369	388	330	237
Valve or Fitting Leak	370	431	419	407	319
Unknown	376	310	334	427	518
All Others (Combined)	1 027	1 154	1 520	1 995	1 520

TABLE 11
Spills By Reason – 1988 to 1992

REASON	YEAR				
	1992	1991	1990	1989	1988
Equipment Failure	1 235	1 124	1 327	1 028	892
Error	1 172	1 343	985	760	533
Container Failure	576	743	794	671	334
Storm or Flood	178	124	145	84	107
Damage By Equipment	148	210	239	199	44
Vandalism	111	122	94	79	46
Unknown	830	741	950	1 445	1 347
All Others (Combined)	764	830	1 152	1 079	769

Figures 11 and 12 summarize the various causes and reasons attributed to spills in 1992. Container leaks, pipe or hose leaks and container overflows caused nearly half of all spills. Equipment failure and operator error were the major reasons for spills. These values are consistent with those presented in previous years.

On each occurrence report, the cause and reason codes are used in conjunction to indicate why and how a spill occurred. An examination of the cause and reason codes used in 1992 reveals that, of a possible 506 combinations⁴, 10 accounted for more than one-third of all occurrences. Table 12 summarizes these combinations.

TABLE 12
Spills By Cause and Reason for 1992

CAUSE	REASON	SPILLS
Pipe or Hose Leak	Equipment Failure	414
Other Container Leak	Error	295
Motor Vehicle Accident	Error	216
Container Overflow	Error	215
Valve or Fitting Leak	Equipment Failure	206
Pipe or Hose Leak	Error	200
Other Container Leak	Equipment Failure	147
Cooling System Leak	Equipment Failure	145
Storage Tank Leak	Corrosion	126
Cooling System Leak	Storm or Flood	99
All Others (Combined)	All Others (Combined)	2 951

⁴Refer to Appendix IV for a complete table of all the cause and reason combinations.

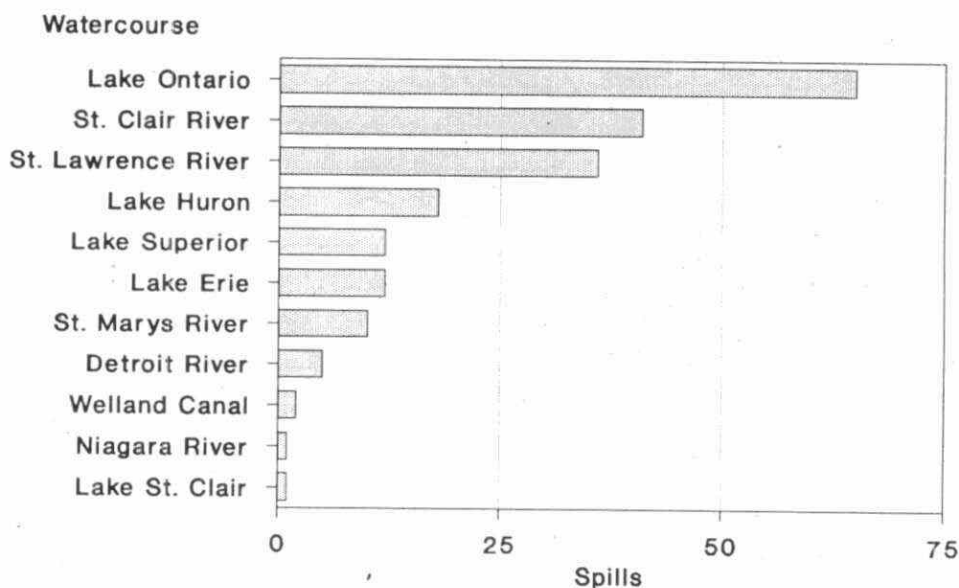
SPILLS TO THE GREAT LAKES SYSTEM

The Great Lakes are a vital component of Ontario's ecosystem. They contain about 20% of all of the world's fresh water. This section of the report focuses on oils and chemicals that spilled directly to the waters of the Great Lakes system. Although spills constitute a very small fraction of total pollution loadings to the Great Lakes, the immediate impact of some spills can have a significant local impact. Shore-based facilities, ships and effluent pipes are all potential discharge points for contaminants.

In 1992, there were 203 spills of oils and chemicals (including chemical solutions) to the Great Lakes system, 85 fewer than in 1991. Figure 13 shows the number of spills to each of the Great Lakes, and their connecting channels, for 1992. Table 13 summarizes these spills by watercourse and sector.

Table 14 and Figure 14 summarize the total number of materials spilled in the oil and chemical groupings. Figure 14 reflects the number of oil and chemical spills to the Great Lakes in volume groups. Of the spills where the volume was reported, 77% were of volumes of less than 1,000 litres. The results from previous years are similar.

Figure 13
Spills of Oils and Chemicals
to the Great Lakes System



Lake Superior

There were 12 spills of oils and chemicals to Lake Superior in 1992. Half of these were from operations of the pulp and paper sector.

St. Marys River

There were 10 spills of oils and chemicals to St. Marys River in 1992, three from metallurgical sector operations and two from pulp and paper sector.

Lake Huron and Georgian Bay

There were 18 spills of oils and chemicals to Lake Huron and Georgian Bay in 1992. Five were from electric utility operations and four were from transportation sector sources.

St. Clair River, Lake St. Clair and Detroit River

There were 47 spills of oils and chemicals to these waters in 1992. Eleven were from transportation sector sources, ten were from petroleum sector operations, seven spills from general manufacturing operations, and an additional seven spills occurred at chemical sector sites.

Lake Erie

There were 12 spills of oils and chemicals to Lake Erie in 1992. Four were from petroleum sector operations and three were from electric utilities' operations.

Niagara River and Welland Canal

There were three spills of oils and chemicals to these watercourses in 1992: one each from operations of the general manufacturing, electric utilities and metallurgical sectors.

Lake Ontario

There were 65 spills of oils and chemicals to Lake Ontario in 1992. Ten spills were from general manufacturing sector sources, nine each from electric utilities, metallurgical, and transportation sector sources, and five from private or residential sources (mainly watercraft).

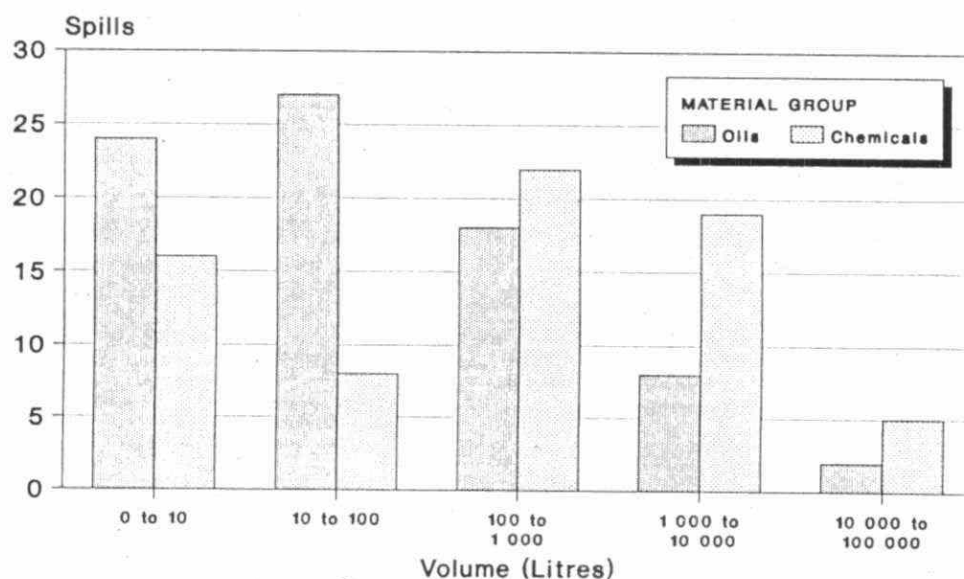
St. Lawrence River

There were 36 spills of oils and chemicals to the St. Lawrence River in 1992. Ten spills were from general manufacturing sector sources, ten spills from pulp and paper facilities, five from chemical sector facilities, and five from private or residential sources.

TABLE 13
Spills of Oils And Chemicals by Watercourse and Sector

SECTOR	WATERCOURSE											TOTAL
	Lake Superior	St. Marys River	Lake Huron	St. Clair River	Lake St. Clair	Detroit River	Lake Erie	Niagara River	Welland Canal	Lake Ontario	St. Lawrence River	
Chemical				6		1				2	5	14
Construction			2							1		3
Food	1					1				3		5
Other Government			1							1	1	3
General Mfg.				7					1	10	10	28
Hydro Utilities	1		5	3			3	1		9		22
Metallurgical		3					1		1	9		14
Mining		1										1
Petroleum			1	10			4			1		16
Pulp & Paper	6	2									10	18
Residential	1	1		2	1					5	5	15
Retail		1	1				1			1		4
Service	1											1
Sewage Utilities							1			1	1	3
Transportation	1	1	4	10		1	1			9	2	29
Other			2							2		4
Unknown	1	1	2	3		2	1			11	2	23
TOTAL	12	10	18	41	1	5	12	1	2	65	36	203

Figure 14
Great Lakes Spill Volumes
By Material Type



Volume was known for 69% of the oils
and chemicals spilled

TABLE 14
Great Lakes Spills of Oils and Chemicals By Watercourse and Volume

MATERIAL & VOLUME (L)		WATERCOURSE											TOTAL
		Lake Superior	St. Marys River	Lake Huron	St. Clair River	Lake St. Clair	Detroit River	Lake Erie	Niagara River	Welland Canal	Lake Ontario	St. Lawrence River	
OILS	Unknown	1	1	5	5		2	5			20	4	43
	0-10		2	2	11	1	1				6	1	24
	10-100	1	1	2	3			6		1	8	5	27
	100-1 000	1		4	1		1		1		7	3	18
	1 000-10 000	2	1								5		8
	10 000-100 000		1								1		2
CHEMICALS	Unknown	2			6		1				9	5	23
	0-10	1	1	1	10						2	1	16
	10-100	2			3						1	2	8
	100-1 000		2	1	7					1	7	4	22
	1 000-10 000	1	1	1	3			1			1	11	19
	10 000-100 000	1		3								1	5
TOTAL		12	10	19	49	1	5	12	1	2	67	37	215

Note that the number of materials spilled (215) exceeds the number of spills (203) due to a number of incidents in which more than one material was spilled.

SPILL CLEANUP IN THE GREAT LAKES

Spills are most difficult to deal with when they impact open water bodies. Currents encountered in the interconnecting channels of the Great Lakes make cleanup even more difficult. Spills of chemicals add another level of difficulty to cleanup efforts, and spills of soluble chemicals, chemical suspensions, or solutions are essentially impossible to clean up.

The cleanup percentage reported for each of the oil and chemical spills to the Great Lakes in 1992 is shown in Table 15. The figures indicate that 70% of these spills were not cleaned up; 11% were mostly or completely cleaned up and the remaining 19% were partially cleaned up. The oil spills had a better cleanup rate than the chemicals, for reasons already described.

TABLE 15
Great Lakes Spill Cleanup By Material Type

MATERIAL TYPE	PERCENT CLEANED UP			
	0%	1-50%	51-90%	91-100%
Oils	63	26	25	20
Chemicals	80	3	8	2
TOTAL	143	29	33	22

PLANNING FOR SPILL CONTINGENCIES

The Ministry of Environment and Energy is actively involved in planning for spill contingencies. The Ministry's Contingency Planning Program is set up to provide advice and assistance to industry, government agencies and others who may have, or respond to, environmental spills. Industries are encouraged to develop spill contingency plans in order to prepare themselves for the eventuality of a spill. In some instances however, the resources of the discharger may be insufficient to deal with a major spill. Several contingency plans are in place to provide a mechanism to deal with such spills when they occur, and these are outlined below.

The Canada/U.S. Water Quality Agreement

Under the *Canada/U.S. Water Quality Agreement* signed by the Prime Minister of Canada and the President of the United States, the two countries agreed to establish mechanisms to deal with spills, pollution monitoring and pollution abatement in waters shared by the two countries. The Agreement calls for a joint contingency plan which organizes the national, provincial/state, and local resources to deal with spills.

The Canada/U.S. Joint Marine Pollution Contingency Plan

The *Joint Canada/U.S. Marine Pollution Contingency Plan* establishes the mechanism, as required by the Canada/U.S. Water Quality Agreement, under which both countries will respond to spills which affect or may affect the other. This plan depends on supporting plans at the federal, provincial/state, and municipal levels. Under this plan, the coast guard of the country in which the spill originates is in charge and MOEE, through the Province of Ontario Spill Contingency Plan, acts in a support role and gives advice on environmental matters. The Ministry's field support is provided through the Regional offices and MOEE's executive support on the International Joint Response Team is provided by the Spills Action Centre. This team is made up of representatives of the responding agencies from both countries and provides an advisory service to the coast guard in charge.

The Canadian Marine Contingency Plan

The *Canadian Marine Contingency Plan* deals with spills from vessels in navigable waters which do not cross the international border. The Canadian Coast Guard is in charge under this plan. Under this plan, MOEE again provides a support and advisory role similar in structure as mentioned above.

The Province of Ontario Contingency Plan For Spills of Oil and other Hazardous Materials

The purpose of the *Province of Ontario Contingency Plan for Spills of Oil and Hazardous Materials* is to establish a reporting and notification protocol for all spills and to provide a mechanism to deal with major spills under provincial jurisdiction which threaten the environment.

It also provides the mechanism through which provincial efforts are coordinated under the contingency plans discussed above. The Plan deals with the containment, clean-up, and disposal phases of spills and is subordinate to plans which deal with contingencies where the threat to life and property is of primary concern. For major spills within MOEE's mandate, the Plan places MOEE in charge and draws on the Ministries of Natural Resources, Health, Labour, Solicitor General, Consumer and Commercial Relations, and Transportation. Two federal agencies, Environment Canada and the Canadian Coast Guard, are also signatories. The Plan relies on a response team concept, consisting of representatives of the participating agencies.

The Province of Ontario Nuclear Plan

The *Province of Ontario Nuclear Plan* is designed to coordinate the response to major events involving nuclear generating facilities. The Plan establishes several groups and organizations on which MOEE serves. MOEE's participation includes sampling under the direction of the Ministry of Labour, participation on the Provincial Ingestion Control Group and the Provincial Restoration Committee established under the Plan.

The Spills Prevention Strategy

The increasing number of reported spills from 1988 to 1990 prompted the Ministry to implement the *Spills Prevention Strategy*. A detailed review of reported spills was undertaken and about 35 companies which had multiple spills at any one location were initially included in this program. Following a series of meetings with identified sources, 29 companies were required to submit comprehensive workplans addressing the following:

- Spill history review and risk assessment,
- An assessment of spill detection, diversion, containment and treatment systems and an implementation schedule for upgrade requirements,
- Emergency response plans and procedures, and
- Environmental awareness training.

The majority of the companies in the program have had their work plan reports approved by the Ministry and have begun implementation of their plans. Approval of the remaining work plans is expected soon. A review of spills reported in 1992 indicates that spills have declined for most of the companies involved in the strategy. The program will be assessed by the Ministry on an ongoing basis.

The Ministry encourages those companies and individuals who are not included in this strategy to assess their operations and minimize the potential for spills. Assistance in this regard is available thorough the Ministry's Contingency Planning Office.

APPENDIX I

SAMPLE OCCURRENCE REPORT



Ministry
of the
Environment

Occurrence Report

Ontario

☐ Initial Report

Complete all applicable sections

☐ Supplemental Report

Complete all shaded and other appropriate sections

Page 1 of

1. Received by		Reg. No.	S.A.C. No.	I.E.B. No.
2. Type of Occurrence		Occurrence Date		
<input type="checkbox"/> Occurrence Code		YY MM DD		
Sub. Cat. Code		Time (24 Hr. Clock)		
Reported by (Name/Organization)		Date Reported YY MM DD		
Tel. No.		Time (24 Hr. Clock)		
Alternate Tel. No.		Date MOE at Scene YY MM DD		
Address		Time (24 Hr. Clock)		
Postal Code		Assigned To: Person/Program		
3. Location of Occurrence		4. Source (Name, Process Area, Address)		
MOE Region Code		Sector Code		
MOE Dist. Code		Source Code		
Municipal Code		SIC Code		
5. Synopsis (75 Characters Maximum)				
6. Summary (Attachments accompanying this report: If <input type="checkbox"/> Yes, number and list them in this Section)				
Multiple reports on single incident: If <input type="checkbox"/> Yes, record initial/master regional number here > >				
7. Follow-up Action <input type="checkbox"/> Abatement <input type="checkbox"/> I.E.B. <input type="checkbox"/> Other (Section Code)				
File Closed: <input type="checkbox"/> Abatement <input type="checkbox"/> IEB <input type="checkbox"/> Other Suspected Violation Code				
8. Reported prepared by		Completion Date YY MM DD		I.E.B. Investigator Assigned
Print/Initial		YY MM DD		Print
Approving Officer		Date YY MM DD		IEB Supervisor
Print/Initial		YY MM DD		Print/Initial

Specify number(s), indicating the routing of the original

Specify number(s), indicating the distribution of the copies

Continued ☐ Yes

1 Investigator or Environmental Officer

2 District Officer/File

3 SAC (all spills)

4 Reg. Dir. / Mgr

5 IEB Reg. Supervisor

6 IEB Head Office/File

7 Other

Occurrence Report

Complete appropriate boxes in this section if this page is used			
Reg. No.	S.A.C. No.	I.E.B. No.	Page of

9. Material 1		Code <input type="text"/>	
Amount 1 (Quantity/Concentration/Duration)		U N No. <input type="text"/>	
Material 2		Code <input type="text"/>	
Amount 2 (Quantity/Concentration/Duration)		U N No. <input type="text"/>	
Cause		Code <input type="text"/>	
Reason		Code <input type="text"/>	
Controller of Material (Name/Organization)			
Owner of Material (Name/Organization)			
Agencies Involved			
10. Clean Up and Restoration Carried Out By		% Cleaned Up	
<input type="checkbox"/> Controller <input type="checkbox"/> Owner <input type="checkbox"/> Other, specify		Est. Cost \$	
Were Directions or Approvals Given Under EPA Pt IX <input type="checkbox"/> No Reg. 11/82 <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Yes		Emergency Generator No.	Waste Class No.
Hauler		System No.	
Disposal Site		Site No.	
Hauler		System No.	
Disposal Site		Site No.	
11. Environmental Impact		Nature of Impact	
<input type="checkbox"/> Confirmed <input type="checkbox"/> Possible <input type="checkbox"/> Not Anticipated		Code <input type="text"/>	
12. People/Business Damaged (Other than Owner/Controller)			
<input type="checkbox"/> No If <input type="checkbox"/> Yes, who?			
Nature of Damage		Code <input type="text"/>	
13. Additional Information (If continuation of Summary, indicate in box in Section 6.)			
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APPENDIX II

SPIILLS BY MATERIAL GROUP AND VOLUME

Spills By Material Groups and Volumes

MATERIALS		VOLUME (litres)								TOTALS	
		Unknown	0-10	10-100	100-1000	1000-10000	10000-100000	100000-1000000	> 1000000		
OILS	Crude Oil		3	3	5	4				15	
	Light Fuels	130	80	205	66	21	5	1		508	
	Light Oils	322	454	790	605	75	8			2254	
	Heavy Oils	35	20	35	43	9				142	
	Other Oils	75	8	20	12	3	1			119	
	Non-Petroleum Oils			9	10	2	1			22	
	GROUP TOTAL	562	565	1062	741	114	15	1	0	3060	58.7%
CHEMICALS	Acids	25	11	32	17	11	6			102	
	Bases	3	3	6	10	7	2			31	
	Halogenated Solvents	3	5	3	2					13	
	Non-Halogenated Solvents	29	25	35	31	7				127	
	Pesticides	2	10	15	7	2				36	
	PCBs	4	38	23	4					69	
	Other Organic	61	21	57	62	16	4			221	
	Other Inorganic	36	19	37	48	34	11			185	
	GROUP TOTAL	163	132	208	181	77	23	0	0	784	15.1%
GASES	Smoke	52								52	
	Dust/Particulate	45	1	4						50	
	NOx	7								7	
	SOx	9								9	
	Natural Gas	10					1	1	1	13	
	Other Gases	135	10	19	22	3	4		2	195	
	GROUP TOTAL	258	11	23	22	3	5	1	3	326	6.3%
WASTES	Liquid Industrial	102	1	29	46	49	35	35	14	311	
	Hazardous Solid	2	1		2					5	
	Non-Hazardous Solid	22	1	1	5	8	1			38	
	Sewage	208	1	10	30	37	26	25	15	352	
	Agricultural	26			1	1	2			30	
	Other	80	33	45	26	11	6	2	3	206	
	GROUP TOTAL	440	37	85	110	106	70	62	32	942	18.1%
OTHER	Feed & Foodstuffs	7		4	5	3	4			23	
	Other	13	1	6	3	9	9	1		42	
	GROUP TOTAL	20	1	10	8	12	13	1	0	65	1.2%
UNKNOWN		25	5	2	2					34	0.6%
TOTALS		1468	751	1390	1064	312	126	65	35	5211	

APPENDIX II

SPIILLS BY MATERIAL GROUP AND VOLUME

Spills By Material Groups and Volumes

MATERIALS		VOLUME (litres)								TOTALS
		Unknown	0-10	10-100	100-1000	1000-10000	10000-100000	100000-1000000	> 1000000	
OILS	Crude Oil		3	3	5	4				15
	Light Fuels	130	80	205	66	21	5	1		508
	Light Oils	322	454	790	605	75	8			2254
	Heavy Oils	35	20	35	43	9				142
	Other Oils	75	8	20	12	3	1			119
	Non-Petroleum Oils			9	10	2	1			22
	GROUP TOTAL	562	565	1062	741	114	15	1	0	3060 58.7%
CHEMICALS	Acids	25	11	32	17	11	6			102
	Bases	3	3	6	10	7	2			31
	Halogenated Solvents	3	5	3	2					13
	Non-Halogenated Solvents	29	25	35	31	7				127
	Pesticides	2	10	15	7	2				36
	PCBs	4	38	23	4					69
	Other Organic	61	21	57	62	16	4			221
	Other Inorganic	36	19	37	48	34	11			185
	GROUP TOTAL	163	132	208	181	77	23	0	0	784 15.1%
GASES	Smoke	52								52
	Dust/Particulate	45	1	4						50
	NOx	7								7
	SOx	9								9
	Natural Gas	10					1	1	1	13
	Other Gases	135	10	19	22	3	4		2	195
	GROUP TOTAL	258	11	23	22	3	5	1	3	326 6.3%
WASTES	Liquid Industrial	102	1	29	46	49	35	35	14	311
	Hazardous Solid	2	1		2					5
	Non-Hazardous Solid	22	1	1	5	8	1			38
	Sewage	208	1	10	30	37	26	25	15	352
	Agricultural	26			1	1	2			30
	Other	80	33	45	26	11	6	2	3	206
	GROUP TOTAL	440	37	85	110	106	70	62	32	942 18.1%
OTHER	Feed & Foodstuffs	7		4	5	3	4			23
	Other	13	1	6	3	9	9	1		42
	GROUP TOTAL	20	1	10	8	12	13	1	0	65 1.2%
UNKNOWN		25	5	2	2					34 0.6%
TOTALS		1468	751	1390	1064	312	126	65	35	5211

APPENDIX III

SECTOR AND SOURCE MATRIX

ORIS SECTOR AND SOURCE CODES

Descriptions of the ORIS Sector and Source Codes are provided below to help explain the categories used in Table III.1

SECTOR DESCRIPTIONS

Chemical	- manufacturers of basic chemicals or feed stocks (including derivative products).
Food Processing	- food processing operations (not including distribution and retail operations)
Metallurgical	- primary refiners of metal ore and scrap metal
Mining	- mining operations (aggregate pit operators, ore mining, etc.)
Petroleum	- manufacturers and retailers of petroleum products
Pulp & Paper	- processors of wood pulp and manufacturers paper products
Other Manufacturing	- manufacturing operations that are not included in any of the more specific manufacturing sectors
Agriculture	- all farming operations including co-ops, farms and ranches.
Construction	- construction companies, builders and contractors
Hydro Utilities	- utilities (both provincial and municipal) which provide electricity to consumers
Sewage Utilities	- utilities (both provincial and municipal) which operate sewage systems
Government	- administrative and other government operations not otherwise specified
Retail	- stores which sell products to consumers
Services	- companies/individuals who provide a service, as opposed to a product (i.e. dry cleaners, hotels/motels, educational facilities, etc.)
Transportation	- companies/individuals whose <u>only</u> business is providing transportation services
Residential/Private	- private citizens

SOURCE DESCRIPTIONS

Aircraft	- all airborne modes of transport
Marine Tanker/Carrier	- waterborne carriers of bulk cargo
Other Watercraft	- other waterborne modes of transport (i.e. ferries, motor boats, etc.)
Train	- vehicles which run exclusively on rails
Motor Vehicle	- automobiles, trucks, motorcycles, etc.
Pipeline	- bulk transport lines (excluding "in-plant" piping networks)
Service Station	- all vehicle servicing facilities (gas stations, marinas)
Storage Facility	- includes all types of storage facilities, both private and commercial
Heat/Power Station	- electrical generating stations (thermal, nuclear and hydroelectric)
Manufacturing Plant	- all manufacturing and processing facilities
Sewage System	- municipal/industrial waste water collection systems (including residential septic systems)
Electric Transformer	- electrical transformers, capacitors, etc.
Water Supply	- municipal water distribution systems

Note that vehicles operated by sectors *other than* transportation (see definition above) are defined as belonging to the sector that operates them. Spills from such vehicles are included in the totals for that specific sector, not the transportation sector.

**Spills By
Sector and Source**

SECTOR	SOURCE														TOTAL
	Aircraft	Marine Tanker/Carrier	Other Watercraft	Train	Motor Vehicle	Pipeline	Service Station	Storage Facility	Heat/Power Plant	Manufacturing Plant	Sewage System	Transformer	Water Supply	Other	
Agriculture					22			21		2				36	81
Chemical					26			2		233					261
Construction					40			6		4				77	127
Food					14					65				1	80
Government	1		1		55	3	2	22					19	106	209
General Mfg.		1			16			11		229				7	264
Hydro Utilities					123			13	76			387		2	601
Metallurgical					14			3	1	200	52	1		10	281
Mining		1	1		9	4		13		12	3	1	1	52	97
Petroleum			5		197	43	182	115		55	1			34	632
Pulp & Paper				1	6					146					153
Residential	4		21		166			186			10	3	1	58	449
Retail					17		32	53		1		1		50	154
Service					57			27		10				60	154
Sewage Utilities					0						282				282
Transportation	5	12	17	43	651		2	32		3				36	801
Other			6		6			4		8	1			12	37
TOTAL	10	14	51	44	1419	50	218	508	77	968	349	393	21	541	4663

The Source and Sector Information was not known for 351 spills.

APPENDIX IV

CAUSE AND REASON MATRIX

ORIS CAUSE AND REASON CODES

Descriptions of the ORIS Cause and Reason Codes are provided below to help explain the categories used in Table IV.1.

CAUSE DESCRIPTIONS

Watercraft Accident	- collision, grounding or sinking of ships, barges, pleasure craft, etc.
Derailment	- accidents where railcars or locomotives leave the rails
Aircraft Crash	- accidents involving aircraft
Motor Vehicle Accident	- road vehicle accidents, truck/trailer overturns
Container Overflow	- overfilling of storage tanks, vehicle fuel/cargo tanks, lagoons, etc.
Pipe/Hose Leak	- discharges from pipes and hoses (other than cooling systems)
Valve/Fitting Leak	- leaks from specific components of equipment, containers and pipelines
Storage Tank Leak	- discharges from stationary above-ground and below-ground storage tanks
Cooling System Leak	- discharges from electricity transformers and capacitors, vehicle radiators, nuclear reactors
Dyke Failure	- failure of storage pond or lagoon walls
Other Container Leak	- spills from containers other than those specified above
Wastewater Discharge	- accidental or unusual variation of wastewater discharges to watercourses from manufacturing/processing facilities, generating stations and sewage plants
Process Start/Stop	- emissions resulting from a change in operating conditions
Process Upset	- an unusual variation in the <i>regular</i> discharge of a contaminant to air due to a fluctuation in the process
Unknown	- cause not determined
Other	- cause not otherwise specified

REASON CODE DESCRIPTIONS

Intentional/Planned	- intentional or planned release
Error	- releases due to mistakes by humans
Vandalism	- illegal/deliberate releases (including sabotage)
Ice/Frost Damage	- freezing, frost heave, the weight of snow or ice, or falling ice
Power Failure	- loss of electrical power
Fire/Explosion	- fires or explosions (<u>not</u> releases that <i>cause</i> a fire or explosion)
Storm/Flood	- storms, floods, lightning, wind, etc.
Equipment Failure	- malfunctions in system components
Container Failure	- corrosion, overpressure, material failure, failure of welds or seams
Damage by Moving Equipment	- containers damaged by vehicles
Gasket/Joint	- failure of any point of connection
Apparent Negligence	- releases due to a lack of diligence
Adverse Road Condition	- road faults, rain, ice or snow, debris on road
Unknown	- reason not determined
Other	- reason not otherwise specified

**Spills By
Cause and Reason**

CAUSE	REASON															TOTAL
	Intentional/Planned	Error	Vandalism	Ice/Frost Damage	Power Failure	Fire/Explosion	Storm/Flood	Equipment Failure	Container Failure	Damage By Moving Equipment	Gasket/Joint	Apparent Negligence	Adverse Road Condition	Unknown	Other	
Watercraft Accident		1	1				2	1	0			1		6		12
Derailment		3					1	2	0						2	8
Aircraft Crash		2							0					2	1	5
Motor Vehicle Accident	1	216				3		13	0			1	59	39	7	339
Container Overflow	2	215	2	6	4		10	83	5			18		23	22	390
Pipe/Hose Leak	6	200	5	17		4	1	414	193	36	31	6		64	19	996
Valve/Fitting Leak	1	73	8	7			1	206	27	4	18	2		16	7	370
Storage Tank Leak	1	48	16	7	1	3	4	49	158	10	5	3		66	6	377
Cooling System Leak		41	9	1	2	9	99	145	50	39	19	1		26	12	453
Dyke Failure							3		0			1		2	9	15
Other Container Leak	28	295	58	8	3	17	9	147	122	58	18	21	20	174	47	1025
Wastewater Discharge	20	19	1	3	72	1	43	103	7			7		29	12	317
Process Upset	1	6		1	12	2		46	8					8	12	96
Process Start/Stop	15	3			4			7	1			2				32
Unknown		3	1			2		3	0					367		376
Other	32	47	10	1	1	33	5	16	5	1		17		8	27	203
TOTAL	107	1172	111	51	99	74	178	1235	576	148	91	80	79	830	183	5014

APPENDIX V

SPILLS BY MUNICIPALITY

Spills By Municipal Location – 1991 to 1992

MUNICIPALITY	SPILLS BY YEAR		POPULATION	AREA (km ²)
	1992	1991		
Metropolitan Toronto	529	559	2 275 771	630
Hamilton-Wentworth R.M.	355	497	451 665	1 113
Niagara R.M.	233	302	393 936	1 851
Ottawa-Carleton R.M.	232	218	678 147	2 757
Peel R.M.	218	192	732 798	1 225
Sudbury R.M.	202	124	161 210	2 607
Thunder Bay District	188	207	158 810	109 564
York R.M.	179	152	504 981	1 756
Lambton County	177	236	128 943	2 997
Durham R.M.	150	141	409 070	2 489
Simcoe County	148	129	288 684	4 842
Waterloo R.M.	132	135	377 762	1 360
Leeds & Grenville County	132	138	90 235	3 390
Stormont, Dundas & Glengarry County	131	162	107 841	3 302
Halton R.M.	130	130	313 136	959
Haldimand-Norfolk R.M.	116	152	98 707	2 911
Algoma District	111	169	127 269	51 207
Renfrew County	97	65	91 685	7 646
Cochrane District	95	104	93 917	145 618
Middlesex County	91	96	372 274	3 361
Kenora District	84	71	58 748	396 871
Wellington County	83	62	159 609	2 659
Hastings County	80	93	116 434	5 967
Essex County	79	83	327 365	1 862
Nipissing District	77	86	84 723	18 011
Muskoka D.M.	70	38	48 005	4 035
Peterborough County	68	71	119 992	3 956
Bruce County	62	49	65 268	4 048
Frontenac County	62	65	129 089	3 820
Northumberland County	56	54	78 224	2 108
Parry Sound District	55	40	38 423	10 057
Brant County	48	50	110 806	1 091
Sudbury District	46	48	26 178	43 275
Huron County	45	35	59 065	3 402
Prescott & Russell County	44	35	67 183	2 003
Kent County	43	53	109 943	2 494
Grey County	42	48	84 071	4 505
Oxford County	36	53	92 888	2 032
Victoria County	36	42	63 332	3 067
Timiskaming District	36	46	38 983	12 705
Lanark County	35	39	54 803	3 064
Rainy River District	35	26	22 997	16 817
Lennox & Addington County	31	27	37 243	2 841
Elgin County	28	31	75 423	1 880
Perth County	22	35	69 976	2 190
Dufferin County	21	15	39 897	1 490
Prince Edward County	19	15	23 763	1 048
Haliburton County	16	6	14 421	4 169
Manitoulin District	9	9	11 192	3 679
Out-of-Province	2	4		
TOTALS	5 014	5 237	10 084 885	916 731

Population and area data from 1991 Census information (Statistics Canada).

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Spills/containment - summary
regional 1992-1993
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